

FastVDO

The logo features the word "Fast" in a black, italicized serif font, followed by "VDO" in a large, bold, red sans-serif font. To the left of "Fast" are four thick, horizontal red lines of increasing length, creating a sense of rapid motion or speed.

like it's meant to be...

AHG19: Resampling Filters for Adaptive Resolution Change (ARC)

❖ Prior Art: H.263, Annex P.

- Reference Picture Resampling
- Includes Global Motion, Warping, Resizing (focus)
- Related to Annex O (Spat. Scal.), Annex Q (RRU)

❖ Support in HEVC

- JCTVC-F158, F618, G264 (ARC introduced).
- Filter design ideas date to JVT-V030 (SVC era).
- Initial application: response to variable channel.

ARC In VVC

- ❖ Numerous use cases now envisioned
- ❖ Variety of syntax approaches available
- ❖ This proposal focuses on the resampling filters
 - Aiming to reuse existing upsamplers, prefer low-complexity on decode side
 - Suggest good downsamplers, allow slightly more complexity at encoder side
 - Simulate application as pre/post, with AI coding

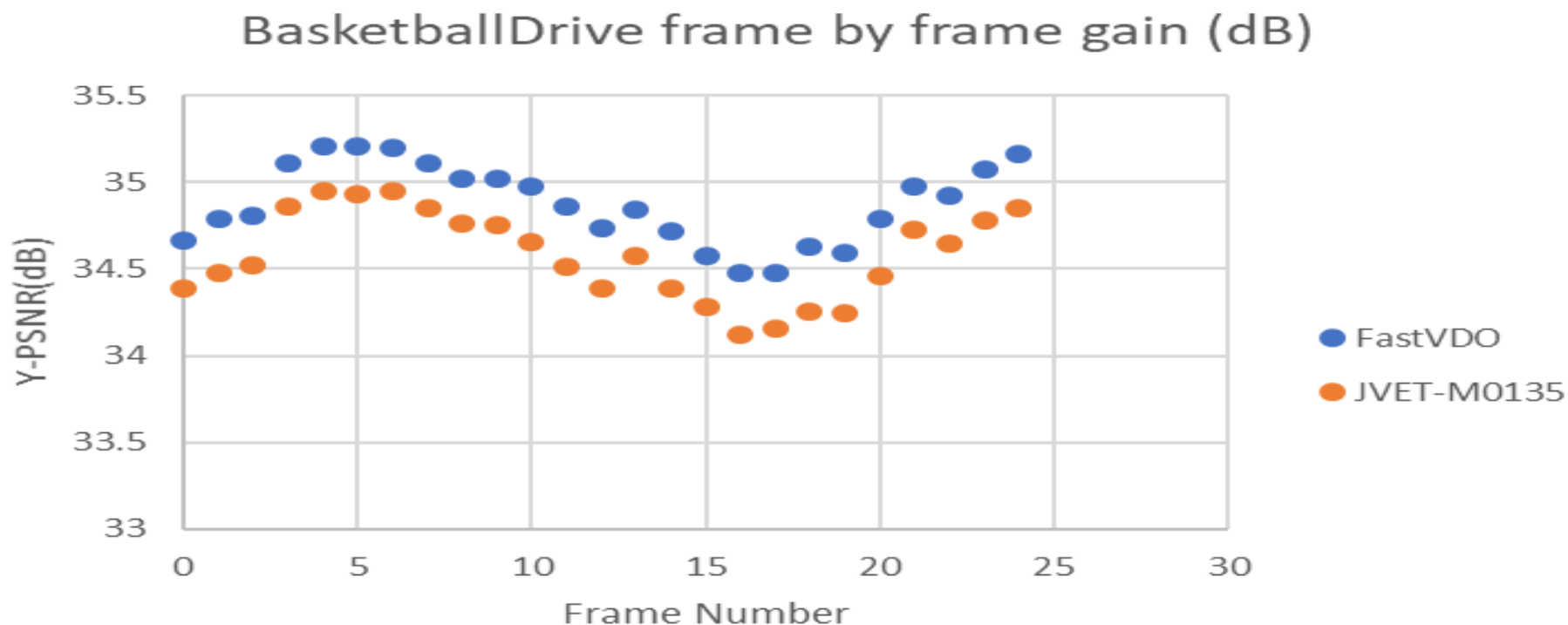
Anchor Vs. FastVDO Filters

- ❖ Anchor (apparently suggested in M0135)
 - Down: $[-1 \ 9 \ 16 \ 9 \ -1] / 32$
 - Up: $[-1 \ 4 \ -11 \ 40 \ 40 \ -11 \ 4 \ -1] / 64$, Table 8-9.
- ❖ FastVDO Test
 - Down: $[1 \ 0 \ -8 \ 16 \ 46 \ 16 \ -8 \ 0 \ 1] / 64$ (~ 7 -tap)
 - Up: $[-1 \ 9 \ 9 \ -1] / 16$. Table 8-6 in VVC Draft 4.5.
- ❖ Upsamplers in VVC Draft; 16 phases available.
 - Proposed is $\frac{1}{2}$ the complexity.

Initial Test: No Compression, 1s Clips Limited Test Data.

		JVET-M0135			FastVDO			Gain(dB)		
Sequences	Resolution;Bitdepth	Y	U	V	Y	U	V	Y	U	V
BasketballDrive	1920x1080;8	34.58	41.801	41.859	34.878	42.017	42.07	0.298	0.216	0.211
Cactus	1920x1080;8	31.553	39.157	40.933	31.713	39.225	40.949	0.160	0.068	0.016
MarketPlace	1920x1080;10	40.747	46.304	48.47	41.144	46.694	48.843	0.397	0.390	0.373
Campfire	3840x2160;10	37.669	35.359	40.925	37.945	35.677	41.249	0.276	0.318	0.324
CatRobot	3840x2160;10	39.961	43.766	44.054	40.212	44.111	44.445	0.251	0.345	0.391
FoodMarket	3840x2160;10	48.04	53.988	55.014	48.322	54.206	55.177	0.282	0.218	0.163
ParkRunning	3840x2160;10	43.646	31.855	34.473	44.49	32.165	34.778	0.844	0.310	0.305
							Average Gain(dB)	0.358	0.266	0.255

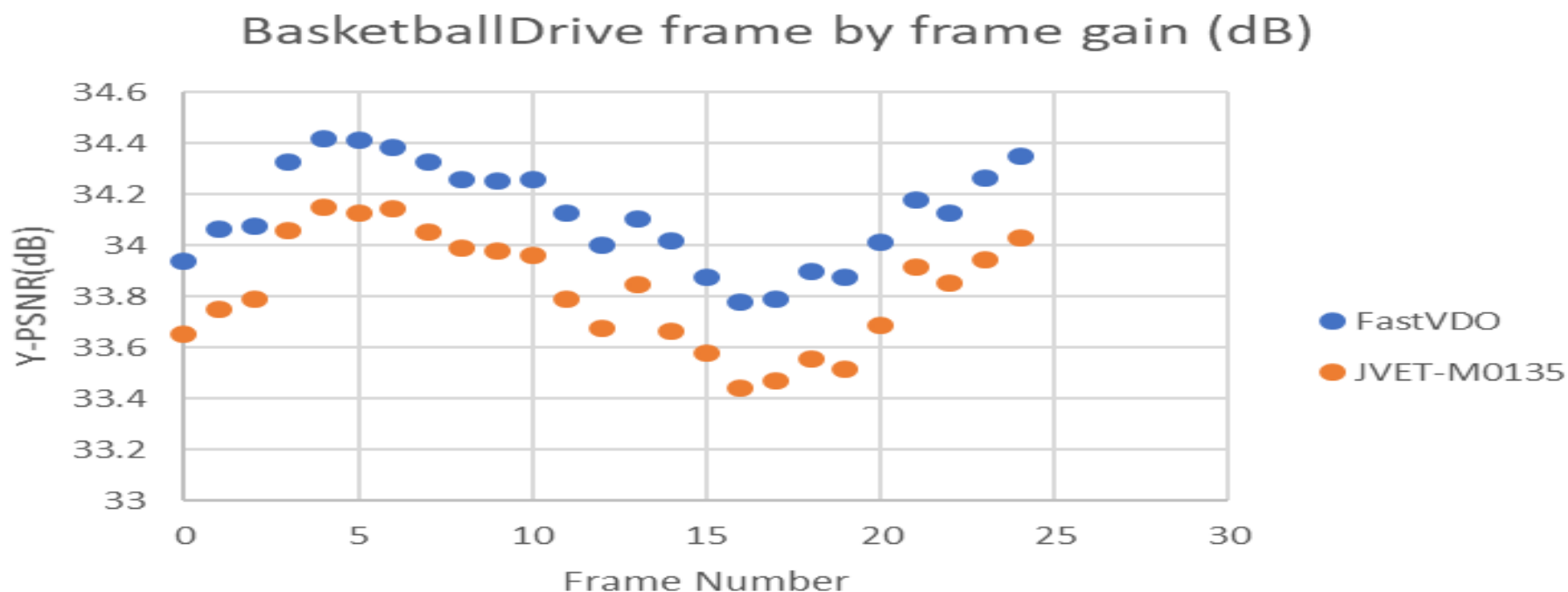
Consistent Gains Across Frames



Second Test: All Intra, Qp=22, 1s Clips, Limited Test Data.

		JVET-M0135			FastVDO			Gain(dB)		
Sequences	Resolution	Y	U	V	Y	U	V	Y	U	V
Basketball	1920x1080	33.654	40.123	39.951	33.981	40.397	40.329	0.327	0.274	0.378
Cactus	1920x1080	31.595	36.825	37.899	31.629	37.085	38.166	0.034	0.26	0.267
MarketPla	1920x1080	36.745	40.848	42.035	37.191	41.047	42.19	0.446	0.199	0.155
Campfire	3840x2160	35.681	34.077	37.718	36.125	34.526	37.86	0.444	0.449	0.142
CatRobot	3840x2160	37.941	39.63	39.43	38.209	39.779	39.747	0.268	0.149	0.317
FoodMark	3840x2160	43.933	45.2	45.396	43.972	45.258	45.502	0.039	0.058	0.106
ParkRunni	3840x2160	37.892	30.618	32.716	38.75	31.119	33.198	0.858	0.501	0.482
							Average Gain	0.345	0.270	0.264

Consistent Gains Across Frames. Results Xchecked by Technicolor*



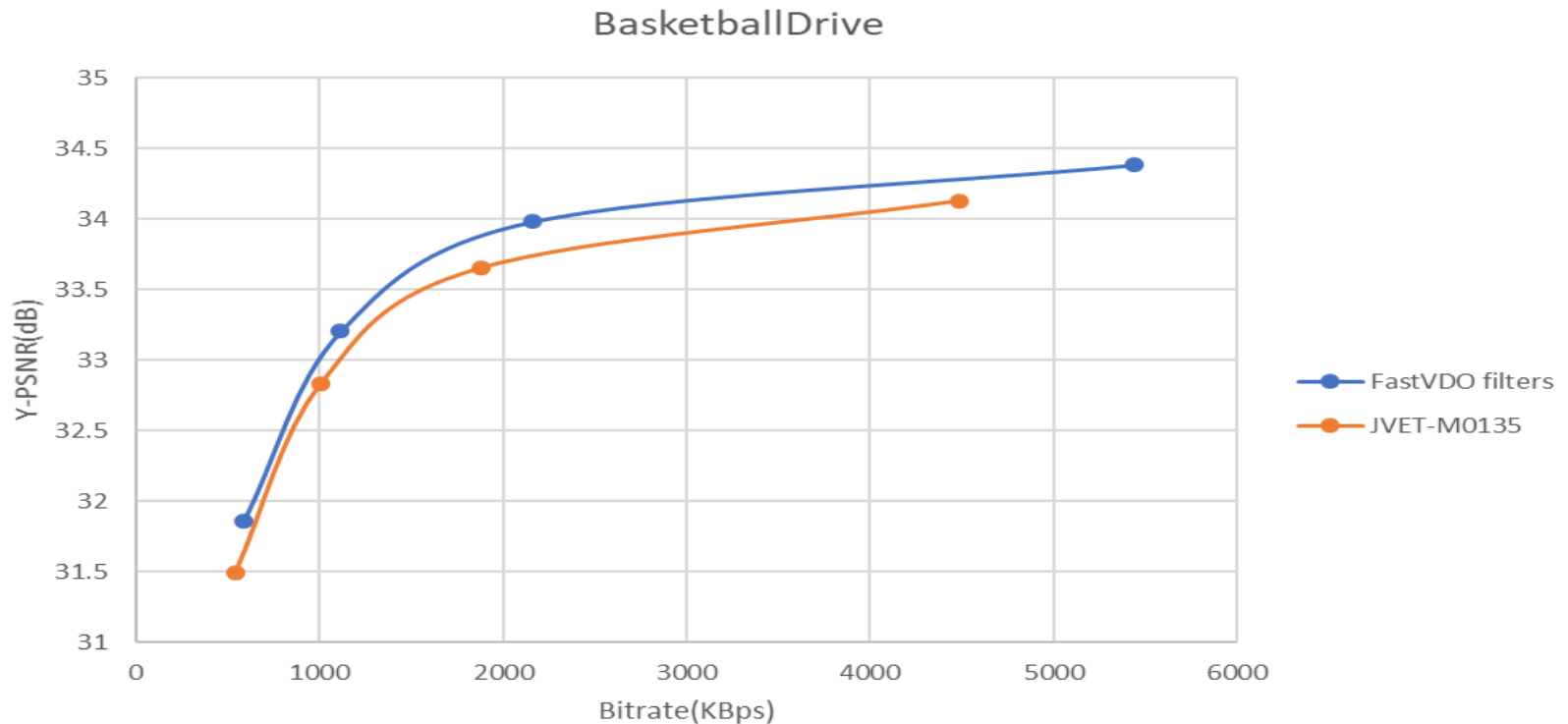
*Many thanks to Tech., JVET-N0669.



Third Test: AI, Qp=22,27,32,37 1s Clips, Limited Test Data. BD-Rate Gains.

	All Intra Main10		
	Over FastVDO filters		
	Y	U	V
4K	-0.23%	-14.76%	-1.03%
1080p	-6.59%	-5.91%	-3.68%
Overall	-2.35%	-11.81%	-1.91%

Consistent Gains Across Bitrates, Example Result.



Example: CampFire Seq, Qp=22. Anchor Has Visual Artifacts.



Example: Bdrive, $Q_p=22$, $Fr=28$.
Loss Of Sharpness with Anchor.



Example: CatRobot, $Q_p=22$, $Fr=16$.
Anchor Has More Alias on Dots.



Quick Conclusions

- ❖ Brief study of resampling filters against an anchor
 - Reduced upsampler complexity, with gains
 - Showed gains without and with AI compression
 - Gains support a variety of applications
- ❖ Suggest CE (or subCE) on resampling filters
 - Study perf. / complexity

Resampling Filters for ARC

0048	No filters proposed
0052	Down: [41,26,7,-5,-6,1], symmetric. Table 8-9, 8-6 (chroma) up, phase 0.
0118	Down: [16,10,0,-3,0,1], symmetric. Up: [-4,54,14,-2]/64.
0279	No filters proposed
0532	Down:[46,16, -8, 0, 1], symmetric. Up: Table 8-6, phase 0.

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